

AD-A137 677

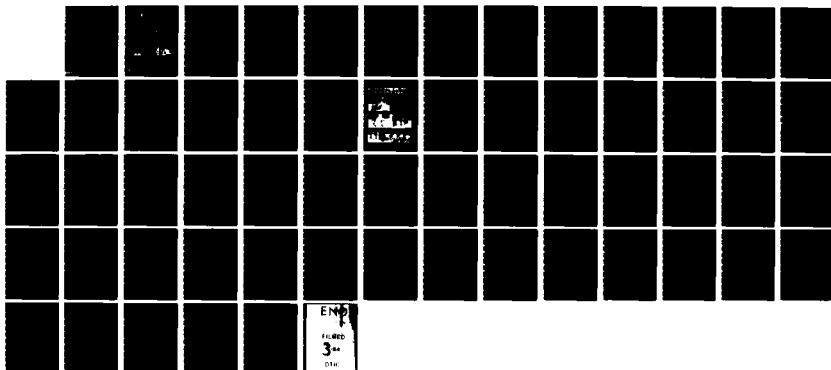
MOBILIZATION AND DEFENSE MANAGEMENT TECHNICAL REPORTS
SERIES A FRAMEWORK F. (U) INDUSTRIAL COLL OF THE ARMED
FORCES WASHINGTON DC D J HEACOX MAY 83 NDU/ICAF-83/009

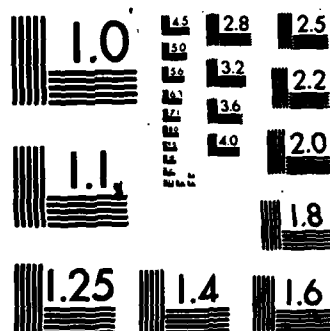
1/1

UNCLASSIFIED

F/G 5/1

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

2

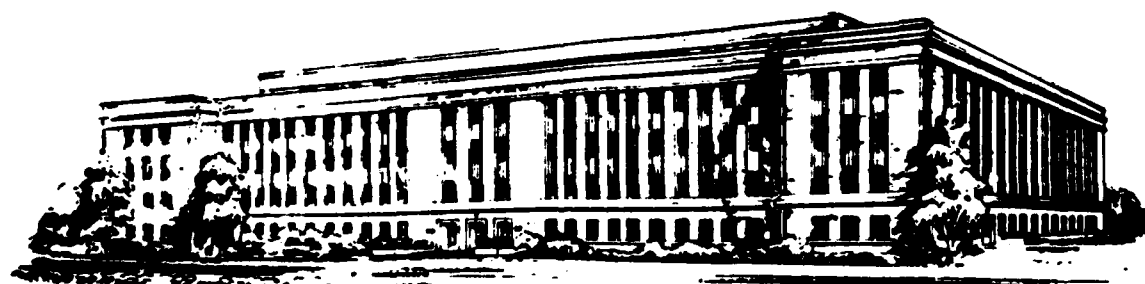


NATIONAL DEFENSE UNIVERSITY

**MOBILIZATION AND DEFENSE MANAGEMENT
TECHNICAL REPORTS SERIES**

AD A137677

**A FRAMEWORK FOR INCREASING DEFENSE
PRODUCTION BY REDUCING PERCEIVED
OPPORTUNITY COSTS**



DTIC FILE COPY

This document has been approved for public release and sale without restriction.

DTIC
ELECTE
FEB 10 1984
A

INDUSTRIAL COLLEGE OF THE ARMED FORCES

84 02 09 059

| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|--|-----------------------|--|
| 1. REPORT NUMBER NDU/ICAF 83/009 AD-A137677 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) A FRAMEWORK FOR INCREASING DEFENSE PRODUCTION BY REDUCING PERCEIVED OPPORTUNITY COSTS | | 5. TYPE OF REPORT & PERIOD COVERED IR #11, AY 82/83 |
| | | 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s) DONALD J. HEACOX, COLONEL, USAF | | 8. CONTRACT OR GRANT NUMBER(s) |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS INDUSTRIAL COLLEGE OF THE ARMED FORCES FORT LESLEY J. MC NAIR WASHINGTON, DC 20319 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS INDUSTRIAL COLLEGE OF THE ARMED FORCES FORT LESLEY J. MC NAIR WASHINGTON, DC 20319 | | 12. REPORT DATE MAY 1983 |
| | | 13. NUMBER OF PAGES 48 |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) NATIONAL DEFENSE UNIVERSITY FORT LESLEY J. MC NAIR WASHINGTON, DC 20319 | | 15. SECURITY CLASS. (of this report) UNCLASSIFIED |
| | | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |
| 16. DISTRIBUTION STATEMENT (of this Report) UNLIMITED APPROVAL FOR PUBLIC RELEASE | | |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) N/A | | |
| 18. SUPPLEMENTARY NOTES N/A | | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) N/A | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A fundamental problem is how to secure funding needed for the hardware and forces essential to our national security. The perceived social and economic costs of defense increases inhibit the public support requisite to sustained defense pro- duction. This paper examines the factors of production in terms of their contri- butions to defense production and the opportunity costs of those contributions. From that examination a framework for increasing defense production by reducing perceived opportunity costs is developed. | | |

THE INDUSTRIAL COLLEGE OF THE ARMED FORCES
NATIONAL DEFENSE UNIVERSITY

MOBILIZATION STUDIES PROGRAM REPORT

A FRAMEWORK FOR INCREASING DEFENSE PRODUCTION BY
REDUCING PERCEIVED OPPORTUNITY COSTS

BY

DONALD J. HEACOX, COLONEL, USAF

A RESEARCH REPORT SUBMITTED TO THE FACULTY
IN
FULFILLMENT OF THE RESEARCH
REQUIREMENT

RESEARCH SUPERVISOR: MAJOR JACK MCDADE

INDUSTRIAL COLLEGE OF THE ARMED FORCES
MAY 1983

| | |
|--------------------|--|
| Accession For | |
| DCIS GRAAI | <input checked="checked" type="checkbox"/> |
| ERIC TAB | <input type="checkbox"/> |
| Unannounced | <input type="checkbox"/> |
| Classification | |
| Distribution/ | |
| Availability Codes | |
| Avail and/or | |
| Dist | Special |
| A-1 | |



EXORDIUM

The fundamental question today is how are we going to fund the hardware and forces essential to our national security. Compelling cases have been made for the necessity of enhancing our strategic capabilities, bolstering our conventional forces, assuring force sustainability, and improving our industrial preparedness.

Nonetheless, the levels of defense spending are increasingly under attack. The traditional reluctance to bear increasing burdens for defense in peacetime seems to be reasserting itself. The perceived social and economic costs of continuing recent defense spending increases are motivating reductions.

How well the defense community deals with these perceived opportunity costs may well determine our ability to survive.

ACKNOWLEDGEMENTS

My research was greatly aided by the cooperation and support of representatives from the following organizations. My thanks and appreciation to them and my advisor Major Jack McDade are hereby extended. My apologies to those I may have inadvertently forgotten.

ADPA, AIA, Bath Iron Works, Chase Econometrics, Commerce Department, Office of the Secretary of Defense, EIA, Hughes Aircraft, Issues Management Letter, Labor Department, NAACP, NEA, NSIA, Public Citizen, Rockwell International, Senate Staff, TMSA, Washington Post, Westinghouse.

DISCLAIMER-ABSTAINER

This report represents the views of the author and does not necessarily reflect the official opinion of The Industrial College of the Armed Forces, the National Defense University, of the Department of Defense.

This document is the property of the United States Government and is not to be reproduced in whole or in part without the permission of the Commandant, The Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C. 20319.

**ABSTRACT OF STUDENT RESEARCH REPORT
INDUSTRIAL COLLEGE OF THE ARMED FORCES**

NAME OF RESEARCHER (S)

Heacox, Donald J.
Colonel, USAF

TITLE OF REPORT

Framework for Increasing Defense
Production by Reducing Perceived
Opportunity Costs

SECURITY CLASSIFICATION OF REPORT

Unclassified

REPORT NUMBER

M IR# 11

ABSTRACT

Problem Statement: A fundamental problem is how to secure funding needed for the hardware and forces essential to our national security. The perceived social and economic costs of defense increases inhibit the public support requisite to sustained defense production. This paper examines the factors of production in terms of their contributions to defense production and the opportunity costs of those contributions. From that examination a framework for increasing defense production by reducing perceived opportunity costs is developed.

Finding/Inferences:

1. There appears to be a growing sensitivity to the perceived opportunity costs of defense production expenditures.
2. Actions are underway addressing those opportunity costs.
3. An integrative framework for these [actions] and additional actions is desirable.

Recommendations:

1. A framework for the defense community to address perceived opportunity costs should consist of:
 - a. A continued, increased, and sustained emphasis on stewardship of public resources;
 - b. A demonstrable sensitivity to opportunity costs;
 - c. Comprehensive and innovative efforts to assure an informed public and to invite evaluation of progress toward longer range objectives; and
 - d. Aggressive efforts to increase the stability and dependability of resource commitments to support defense production.
2. Some specific actions within that framework include:
 - a. Increasing the personal sensitivity to and accountability for public resources through portrayal of opportunity costs, reduced resource span of control, and increased specificity of resource management responsibility;
 - b. Using "viability indicators" to identify programs whose opportunity costs may have become excessive;
 - c. Using defense strategies that consider hardware mixes keyed to net social and defense costs;
 - d. Publicizing the "opportunity benefits" of defense spending;

THIS ABSTRACT IS UNCLASSIFIED

- e. Projecting Soviet threat and intentions realistically [for the public];
- f. Expanding proactive advertising by the defense community;
- g. Incentivizing production capability investments by demand for production end items [rather than by directly subsidizing the increased capability at the expense of current production].

TABLE OF CONTENTS

| CHAPTER | PAGE |
|---|------|
| TITLE PAGE..... | i |
| EXORDIUM..... | ii |
| ACKNOWLEDGEMENTS..... | iii |
| DISCLAIMER-ABSTAINER..... | iv |
| ABSTRACT..... | v |
| TABLE OF CONTENTS..... | vii |
| EXECUTIVE SUMMARY..... | viii |
| I. INTRODUCTION..... | 1 |
| Perspective and Purpose of the Study..... | 1 |
| Organization and Focus of the Study..... | 1 |
| II. BACKGROUND..... | 3 |
| Production..... | 3 |
| Productivity..... | 6 |
| Opportunity Costs..... | 7 |
| Requisites for and Barriers to Increasing Defense Production..... | 7 |
| III. EXAMINATION OF THE FACTORS OF PRODUCTION..... | 17 |
| Land..... | 17 |
| Labor..... | 19 |
| Capital..... | 20 |
| Intrepreneurial Skill..... | 21 |
| Technology..... | 22 |
| IV. FRAMEWORK FOR INCREASING DEFENSE PRODUCTION BY REDUCING PERCEIVED OPPORTUNITY COSTS..... | 25 |
| Stewardship..... | 25 |
| Sensitivity to Opportunity Costs..... | 25 |
| Public Information and Tracking to Longer Range Objects..... | 26 |
| Stability and Dependability..... | 29 |
| V. ADDITIONAL SPECIFIC ACTIONS..... | 30 |
| Stewardship Actions..... | 30 |
| Actions Directly Reflecting Opportunity Costs..... | 33 |
| Public Information Actions..... | 37 |
| Stability and Dependability Actions..... | 39 |
| VI. CONCLUDING REMARKS..... | 41 |
| NOTES..... | 42 |

EXECUTIVE SUMMARY

Defense production increases supportive of United States national security require increased government funding. That government funding is, in turn, dependent upon public understanding and support. Public support, in turn, depends on perceptions of the opportunity costs of defense spending. The body politic must perceive the opportunities of decreased deficits and of increase social program spending less important to the national interest than the increased security resulting from increased defense expenditures.

A framework from which the defense community might act to secure this support consists of:

- A continued, increased, and sustained emphasis on stewardship of public resources;
- A demonstrable sensitivity to opportunity costs;
- Comprehensive and innovative efforts to assure an informed public and to invite evaluation of progress toward longer range objectives; and
- Aggressive efforts to increase the stability and dependability of resource commitments to support defense production.

Within that framework, a number of actions are already underway. Fraud, waste, and abuse programs address stewardship. The development and application of the Defense Economic Impact Modeling System (DEIMS) demonstrates a sensitivity to opportunity costs. Public information initiatives and a focus on longer range objectives are evident. Defense contractors, led by Bath Iron Works, are starting to take their story to the public. Consistent with longer range objectives, a stable and dependable growth in defense is being charted. DEIMS is being used to predict the labor and material demands so that industry can better plan their facilities and investments to meet the demands.

Some additional suggestions for actions within the framework are:

- Increase personal sensitivity to and accountability for management of public resources through opportunity cost portrayal, decreased economic span of control, and increased specificity of responsibility;
- Use "viability indicators" to identify programs whose opportunity costs may becoming excessive;
- Consider in defense strategies the employment of hardware that tends to minimize total defense and social costs;
- Publicize "opportunity benefits" of defense spending;

- Project the Soviet threat and intentions for the public realistically;
- Expand carefully the current initiatives of defense contractors to take their story to the public;
- Incentivize investment through demand for production end items rather than by subsidizing investments in surge or increased production capability at the expense of current production.

Military, industrial, and economic strength can all be limited by insufficient national determination. Many speakers at the Industrial College and many contemporary writers cite the need for greater public support. This paper outlines a framework and some specific actions that may be useful in gaining public acceptance of the defense spending requisite for national security.

CHAPTER I

INTRODUCTION

Perspective and Purpose of the Study.

The challenge of assuring adequate defense production appears to be twofold: to increase defense productivity and to secure the necessary funds for increased production.

The two challenges are related in several key ways. Increased productivity can reduce the requirement for additional funds. Increased productivity can demonstrate competence and stewardship that motivate greater support from production spending because it is not perceived as wasteful. And increased productivity may itself require additional funding to make the initial investments required.

This study develops a framework from which one may address public resistance to increase defense production by more fully considering the perceived opportunity costs of such spending. Recognition of the importance of public support and of the importance of sensitivity to opportunity costs appears to be growing. Many individual actions are underway that address the problem. This paper is designed to contribute a framework for such efforts and to suggest some additional specific actions which may be desirable.

Organization and Focus of the Study.

By way of background, production, productivity and opportunity cost concepts will be discussed. The factors of production will then be examined in terms of their contributions to production and the opportunity costs of those contributions. The focus will be on the defense electronics industry.

The focus on defense electronics is motivated by a variety of considerations. Electronics production is increasingly important to our defense and our economy. Defense and commercial electronics are related in interesting ways. The dynamics of the electronics industry make it uniquely illustrative. Barriers to and requisites for increasing defense production will also be examined.

From those examinations of production factors and the requisites and barriers to increasing defense production, a framework will be proposed from which to address the barriers and perceived opportunity costs. Consistent with the framework additional specific actions will be suggested.

CHAPTER II

BACKGROUND

Production.

There are many ways to look at production and production has been looked at in many ways. The different approaches spring from differing individual perspectives, the inherent complexity of production process which invites diversity, and the imperfections and weaknesses of prior approaches which subsequent approaches attempt to redress.

From an economic perspective, production results from a combination of factors. Generally the factors of production are listed as land, labor, capital, entrepreneurial skill, and technology. This general relationship can be expressed mathematically by $P=f(L,L,K,E,T)$, where P(roduction) is equal to a f(unction) of L(and), L(abor), K(apital), E(ntrepreneurial skill), and T(echnology).

Determining or approximating the nature of that function presents additional challenges. Several basic approaches are employed. I will very briefly describe the Cobb-Douglas approach and the Input-Output approach.

The Cobb-Douglas approach depicts production as a process requiring both capital and labor for there to be any production. A simple formulation would be of the form $P = A K^{\alpha} L^{\beta}$.¹ P(roduction) is equal to the product of K(apital) employed with a productivity represented by the exponential power α , times L(abor) employed with a productivity represented by the exponential β , multiplied by a scaling factory, A.

If one tracks production versus capital and labor over time, approximations for A , λ , and γ can be developed. Using these approximations one can then predict what changing labor and capital might do to production.

This basic approach is often modified to incorporate other factors and evaluate their predictive value. Without getting into details, a couple of formulas will be presented along with their use to illustrate the kinds of things currently being done.

The formula $Q = A e^{\lambda t} E^g K^m$ depicts output, Q , as the product of a scaling factor, A ; the constant e raised to a power λt that represents a rate of neutral technological change; E , the ratio of civilian employment to the civilian labor force raised to the power g which represents the elasticity of capital utilization with respect to the employment ratio times the constant; K , the stock of capital and m , manhours, raised to powers indicated.² It is used to help determine the effect of capital utilization on productivity. The formula $\frac{dQ}{dA} = \frac{Q}{A}$ is used to show that basic research can speed the change in total factor productivity.³

What should one make of this? What relevance does it have? I suggest that three things ought to come to mind. First, mathematical techniques exist to model production. Second, that these techniques are, at best, approximations. Third, that there is not common agreement on which techniques to use - which can be shown by looking at another approach.

Another way of viewing production would be as a series of inputs of specific types of labor and material being transformed by a black box into a

series of outputs of products. There are models that represent this process for very large systems indeed. The Soviet Union is a planned economy. Determining how much specific labor, material, and intermediate products are needed as inputs to produce the desired series of final output products presents enormous challenges to them. Their determinations, in essence, result from solving equations that represents the input-output process. The United States, though not a planned economy, also employs large input-output models. Though resources in the United States free market or mixed economy are largely allocated as the result of natural processes of supply and demand, models can be used to assess the impact of changing inputs on outputs or the inputs needed for certain levels of outputs.

One such series of United States models is known as DEIMS (Defense Economic Impact Modeling System). The purposes of DEIMS are:

- To analyze the economic impact of defense expenditures on the United States economy using a consistent and reliable framework of economic models and government policy assumptions.
- To provide planning information on defense requirements to private sector firms in order to alert these companies to sales opportunities as well as encourage companies to add additional capacity where needed.
- To allow the Department of Defense to analyze the impact of alternative defense budgets on key industrial sectors, skilled labor categories, and raw material requirements.⁴

I conclude from this that the Department of Defense is sensitive to the impact of defense production on the economy as a whole and that the economy as

a whole impacts defense production. Furthermore, the DOD has and is using tools to evaluate these impacts. The tools and the resulting assessments, while extraordinarily valuable and useful, are subject to limitations and the results will always be approximations.

Productivity.

What can be said about production applies even more so to productivity. There are differing approaches with differing limitations from differing perspectives to address productivity. How and what to measure remains a challenge.

Productivity can be expressed as output per input. Often, it is the dollar output of goods and services per manhour expended. Sometimes it is the output per total input. The term total factor productivity is often used to describe that relationship. Manipulations of the Cobb-Douglas formula are used to measure and evaluate total factor productivity and the rate of change of total factor productivity.

Productive efficiency is another term used to indicate a productivity concept. It is a measure of how much of our total productive capability we are employing. It is a linear programming approach.

Efficiency is equal to current production (P) divided by maximum production(p^*). The maximization problem is then expressed as

maximize px

subject to

where F is a matrix of the factors of production over time
(capital, labor, energy, and intermediate purchases)

and F is the limit of those factors at a given period of time.⁵

The relevance of this is again that imprecise but useful tools exist for assessing productivity. Later in the paper, the total factor productivity and productive efficiency concepts will be useful in developing a framework for increasing defense production by decreasing perceived opportunity costs.

Opportunity Costs.

Opportunity cost is an economics concept and term. It is what you cannot do or forego because you do something else. For example, if one has only \$5 and buys beer and pizza, one cannot use the same \$5 for investments. If one spends money for defense production, one cannot spend the same money to reduce the national debt or to fund social programs. One must trade off expenditures of one kind against the other. This is commonly called "guns or butter." Perhaps today it would be more accurately described as guns or deficits or social programs. The Beetle Bailey cartoon courtesy of King Features Syndicate, overleaf, illustrates a popular perception.

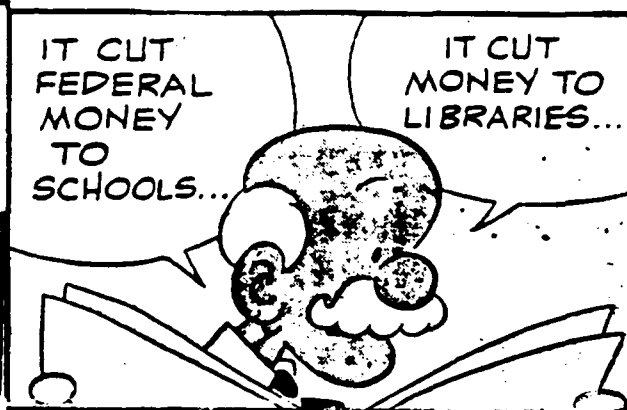
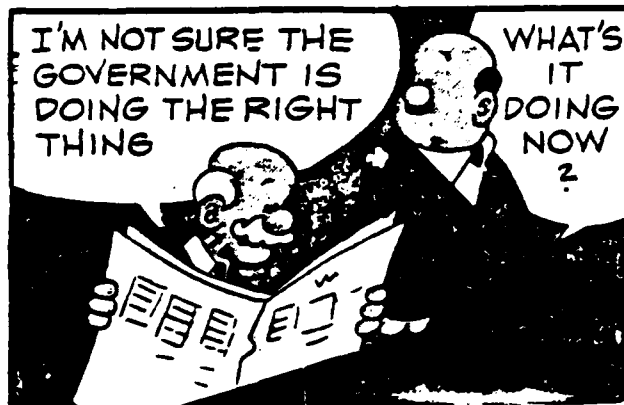
Thus, in gross and general terms, today, the serviced opportunity costs of increased defense spending appear to be decreased funding of social programs and increased budget deficits. In addition, there are some interesting characteristics of defense, especially defense electronics production spending, that may create unique opportunity costs. These shall be addressed as we examine the factors of production in detail.

Requisites for and Barriers to Increasing Defense Production.

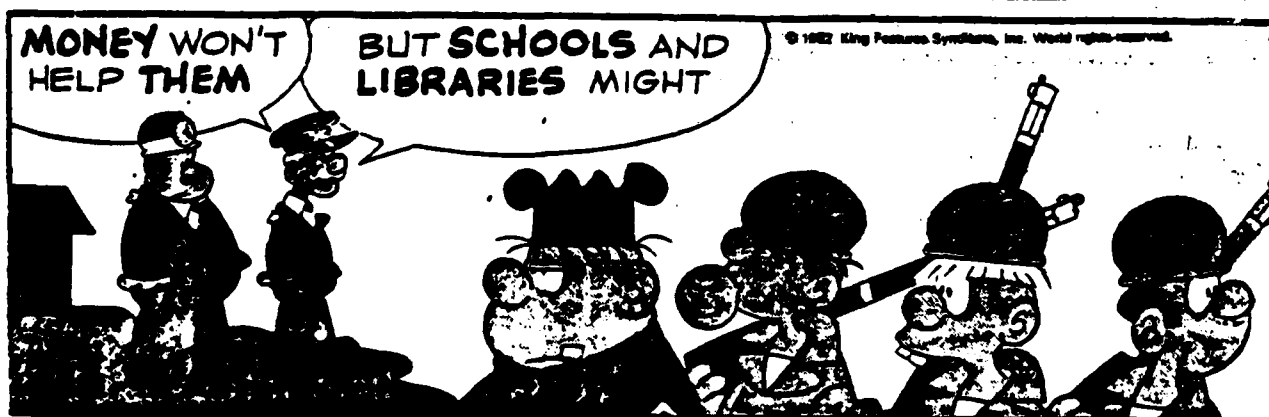
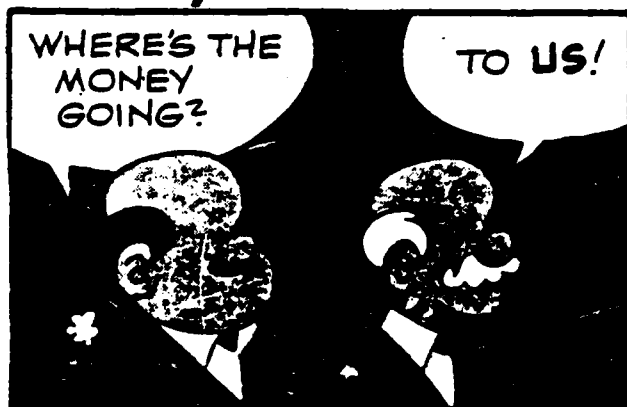
To increase defense production, we need to increase the factors of production. That is we need more labor, more capital, more land, or to employ them better through greater entrepreneurial skill and technology.

THE COMICS

BEETLE BAILEY



by Mort Walker



Let me briefly elaborate in terms of a basic Cobb-Douglas model.

If K or L or A , then we need more K or L or to increase the productivity of capital (K) and labor (L) we are already employing. We could also change the scaling factor (A) by reducing government regulation, for example.⁶ Reducing government regulation would of course involve tradeoffs between production and the goals of regulation.

Increasing the factors would require additional funding. Some gains could be theoretically made by actions which increase the productivity of existing labor and capital; however, even these would likely require seed money. Furthermore, when one examines the disparity of defense spending between ourselves and the Soviet Union over the last decade or so, productivity improvement alone appears insufficient to the task.⁷

If we reflect on the linear programming approach, we could get more total production if we produced a product mix that maximally employed the factors of production. That is, by taking advantage of our excess capacity and reducing products that compete for the same scarce resources, we could produce more total valued products. If we consider all possible product mixes as a production possibility frontier, we are moving out to and along that frontier as best economically as we can. Of course, we may not like the resulting product mix as well as the previous product mix. In addition, moving along the production possibility frontier often entails costs of converting production capability to produce new, different, or different rates of products.

The bottom line is that additional production, for the moment at least, will require additional resources and, as I hope to show, that these resources

come from the federal budget. Resources within the DOD can be shifted to increase production at the expense of other DOD programs. Those shifted resources would still be federal. Resources could be shifted from other governmental sectors; these too would remain federal resources. Added federal resources could be allocated to defense production.

Contractor investment could improve production but such investment must necessarily flow from federal expenditures. The profits on defense contracts could be plowed back into productivity investments; however, the source of those profits flow from the federal government. In addition, there has been a tendency to disinvest in such productivity improvements. Contractors could plow profits from the commercial sectors of their business into the defense sector. This would truly provide an external source of funding defense productivity improvements. However, until very recently the trend has been in the other direction. Commercial investments were expanded at the expense of the defense sectors.⁸ Thus, realistically, the federal government remains the necessary source of funding increases for defense production and defense productivity.

Barriers to increasing defense production fall into two general categories. These categories correspond to the challenges of increasing defense production. The first general category is barriers to productivity, the second barriers to increased funding.

This paper focuses primarily on overcoming public resistance to funding as that is perceived as the greater limitation. A number of publications have addressed the problems inhibiting productivity in the defense industry. I will recap selectively the most significant in my opinion as a distillation of a number of studies, books, and personal experience.

The first and, in my opinion, the most significant is instability. The uncertainties of the budget process make orderly research, development, production, and deployment impossible in many instances. Economies of schedule and efficient production lots are sacrificed. Effective employment on a given project can be subject to considerable peaks and valleys of funding.

The uncertainties of the budget process can be compounded by uncertainties associated with requirements based on dynamic threat, technological opportunities, and tactics. Thus the perceived vagaries of employment and reliable opportunities for gain have motivated workers, engineers, managers, visitors, and subcontractors to abandon or reduce their reliance on defense efforts. While the participation of defense oriented prime contractors has been fairly constant, some large corporations have deliberately sought to expand their commercial activities while reducing their relative dependence on defense contracting.⁹

The costs of instability of the budget and instability of labor at the plant level could be conservatively estimated by Dr. Jacques Gansler at \$1.185 billion a year.¹⁰ The real costs maybe significantly higher.

The second problem is that there are inadequate incentives to increase productivity. My belief is that the general conclusions of Bela Gold are specifically applicable to the defense industry and that "diminishing rates of progress in the productivity and technological capabilities of major sectors of industry are attributable in greatest measure not to complacency, indifference, sloth, or ignorance, but to the absence of incentives attractive enough to offset the active deterrents to undertaking such improvement efforts."¹¹

Incentive contracts have been shown to be generally ineffective.¹² In my view, (shared by others) this is for three basic reasons. First, survival and not profit maximization is the basic motivator of defense industries. Second, it is the results of the combined series of contracts over time that a prudent manager seeks to optimize - in terms of survival, profit, or whatever. Therefore, the focus of incentives in an incoherent way, on individual contracts could produce the desired results only through the greatest coincidence. Third, without a reliable market that expands rather than contracts as a result of productivity investments, those investments will not be forthcoming no matter how greatly incentivized. This is a view shared, I believe, by many defense contractors, but only expressed in confidence. (Multi-year contracting circumvents this last concern somewhat by guarantying some recovery of investments if contractually defined production levels are not achieved because of subsequent government termination actions.)

The costs associated with failing to implement various productivity improvements and failing to trim overhead have been estimated by Dr. Gansler at \$2.25 billion a year.¹³ Don Moore and I had projected a billion dollar savings from expanding and improving contractor implementation of work measurement systems.¹⁴

The challenge in this area, was also described by Gold, "... governmental agencies concerned with the encouragement of technological progress in the national interest would patiently benefit from increasing empirical insights into the effects of various kinds of technological innovations under specific conditions and into the technological responsiveness of different industries to shifting factor price - as bases for considering

the desirability of seeking to modify relevant industrial decisions."¹⁵ In other words we ought to know what we are doing before we do it - a message with social ramifications.

The third general barrier to productivity is the restrictions to expanded participation in the market. Sophisticated (or at least complex) government procurement requires contractor time and money to develop the requisite systems, understanding, and relationships to accommodate requirements for cost accounting, quality assurance, work measurement, electromagnetic compatibility, human factors, and so on. Proposal preparation and independent research costs can be significant. Funding uncertainties and changes can delay awards requiring significant investments for a considerable period prior to the receipt of funding for the first government contract.

These restrictions can hurt productivity in several ways. Competition is reduced.¹⁶ Innovation can be inhibited for the small companies with novel ideas and those companies may be discouraged from entering the defense business.¹⁷ Costs tend to increase from relying on contractors with high overheads resulting from the large proposal teams and numerous specialists.

The fourth general barrier to productivity is the already institutionalized practice of requiring defense expenditures to address socio-economic problems.¹⁸ Public law and the Defense Acquisition Regulation contain a number of provisions designed to have defense spending serve the perceived national interest in ways other than getting defense items for the lowest cost. Included are provisions for protecting union wages, targeting of contracts to geographical areas of high unemployment, directing assistance to small businessmen, offering equal employment opportunity,

channeling contracts to minority enterprises without benefit of competition, prohibiting construction of naval vessels in foreign shipyards, preserving a mobilization base for jeweled bearings, restricting the acquisition of foreign buses, restricting the purchase of specified classes of commodities of foreign origin, prohibiting employment on Government contracts of prisoners, requiring mandatory purchase of specified supplies from Federal Prison Industries, Inc., purchasing meat only from suppliers who conform to standards of humane slaughter, prohibiting contracting with a company convicted of criminal violation of air pollution standards, and so on.¹⁹

These restrictions, in some cases, may result in significant cost premiums. Paying union wages in areas where the prevailing wage rates are lower is one example. Buying ships from Japan might also be significantly less costly than U.S. construction. Some work set aside for small businesses and minority enterprises may prove unsuitable and have to be redone later by a larger business. The point is not that the restrictions are bad per se it is that we may be paying, in essence, defense dollars in the form of lost economies to help meet certain socio-economic objectives.

This process of trying to serve several masters with a single dollar suggests that a traditional concept of productivity may be inappropriate. The real output desired is goods, services, and progress toward social goals from a measured input of labor and/or capital. Keep this in mind when we are considering actions within a framework for reducing perceived opportunity costs.

I would like to arbitrarily categorize the barriers to securing funding for defense production as resistance to requirements, resistance to waste, and resistance to opportunity costs.

Resistance to requirements develops, I suggest, in several ways. Traditionally the people of the United States have resisted peacetime buildup of military forces.²⁰ If a threat was perceived and understood, support of military spending was assured. If not, then support becomes questionable. The complex technological threats, tactics, and strategies involved in the selection, development, and production of defense systems is not easily grasped. The task of winning public support for these systems is further complicated by the political aspects of the process and by disagreements or controversy within the defense community as to which system is needed. This internal disagreement has helped stimulate external criticism of systems on technical grounds, which is a relatively recent phenomenon.²¹ No longer does the lay community accept without question the positions of the defense community expert. This increases the challenge of making technical decisions and approaches rational and understandable to the public.

Resistance to waste is understandable. Spending to meet even valid requirements may be resisted if it is thought that spending will be excessively wasteful. Defense spending suffers from perceptions of waste for several reasons.

The absolutely high levels of spending mean even isolated instances of waste could result in the potential for multi-billion dollar horror stories. The vastness of defense spending also increases the number of opportunities for horror stories. The media and the American people seem to focus on bad news and a balanced sense of perspective is often absent.²² In this regard there is a sense that Defense may be, relatively, the best managed (least wasteful) government department; however, some of those opposed to increased Defense spending say that that is to be expected and the Department of Defense should be held to higher standards of performance than departments devoted to addressing social concerns.²³ This dual standard offers a potential for exploitation to the benefit of both Defense and non-Defense agencies. The barriers to productivity discussed above may also contribute to perceptions of waste.

Finally, defense spending may be resisted because of the opportunity costs.²⁴ The funds spent addressing even valid defense requirements in an efficient manner may be perceived to be better spent on human services or not spent at all to decrease a budget deficit. If requirements are not clearly understood and waste is also perceived, the opportunity costs will be perceived to be even greater.

CHAPTER III

EXAMINATION OF THE FACTORS OF PRODUCTION

This section analyzes the factors of production in terms of their contribution to production and their opportunity costs, especially when associated with defense electronics production.

The factors discussed will be land, labor, capital, entrepreneurial skill and technology, following the economic formulation of production at the outset of the paper. Real property and plant facilities will generally be included in "land." Engineers and engineering will generally be included in "technology" although some of the discussion of "labor" will apply to engineers and managers ("entrepreneurial skill"). Material is included under "capital."

Land.

Land and other fixed assets contribute to production by virtue of their geography and their quality. Industries were located economical distances from resources. The resources could be minerals, other industries, trade routes, commerce centers, or, as in the case of electronics, the educational centers of the San Francisco Bay area's "Silicon Valley," and Boston's Route 128.

As the economies of location change, the economics of production at that location also change. Mineral quality, trade routes, transportation modes, energy supplies, and so on are altered over time. Labor costs, too, tend to be regional. The flight of the textile industry from New England is one

example of a geographic response to changing economics. The historical economies of iron and coal production led to the concentration of steel industries in the Midwest, which led, in turn to the concentration of automobile industries. Thus declines in those heavy industries produce severe regional distress.

Land may be the scarcest and least flexible factor of production. Whole industries are not easily relocated from one location to another.

These changes create barriers to and opportunities for productivity improvement. Costly change may be required to revitalize a dying industry or to transition that industrial capacity (L,L,K,E,T) to a more viable sector.²⁵ It may be that transition of the industrial capacity is necessary to spark continued progress. The completed transition - as from buggies to automobiles or from manual computations to computers - may result in the creation of more wealth and more jobs. At the same time, pressures to ease the economic plight of those disrupted by the transition may create added demands on the, at least temporarily, declining resources of a declining industry in what may be a declining economy.

Geography also impacts the ability to secure support for defense production. As Senators and Representatives represent geographical constituencies, where an industry receiving defense work is located can be an important consideration. The prosperity of their districts is directly affected by defense spending. The strategy of trying to spread lower tier defense work across a broad geographical base in order to maximize the political impact has been employed.²⁶ In addressing those who would wish to

cut defense expenditures, Senator Tower requested Senators, "candidates for reduction" in "military installations or contractor operations."²⁷ There were none.

The opportunity costs of land use to support defense production are simply that that land is not then available for farming, housing, recreation, or other kinds of industrial production. Other industries may also generate less toxic waste, fewer potential pollutants, or fewer moral or safety concerns than defense.

Labor.

Labor has been the primary focus of productivity. The Cobb-Douglas equation was philosophically deliberately multiplicative, that is without both labor and capital there would be no production. While there have been continuing efforts to improve human output through using superior tools, machines, methods, psychology, physiological and genetic characteristics, man-machines interface, automation, or computers; the focus had been on the traditional output per manhour. The decreased costs of labor were compared to the increased investments required to make the labor more productive and the output of the new labor capital mix. The labor component of the land, labor, capital, entrepreneurial skill, and technology tended, on the whole, to prosper with the transition and growth of industries and productivity.

I offer three observations that require or reflect a change in the focus on productivity. First, the prosperity generated from increased productivity has been used, in part, to cushion the adverse impacts on labor of unemployment, disability, illness, displacement, and retirement.²⁸ The

institutionalization of that process alters the cost to society of productivity gains creating unemployment. Second, as labor has shifted into the service sector, it has become increasingly more difficult to find meaningful measures of productivity in terms of output units per manhours.²⁹ Third, the extension of current automation trends and expanded use of robotics may well portend a decline in total industrial employment. The numbers of jobs being created as the result of robotics and increased automation may be fewer than the numbers of jobs displaced as the result of the increased productivity.³⁰

The opportunity costs of employing labor on defense production is that that labor is unavailable for other work. A unique criticism of defense spending is that it creates fewer jobs than most other types of spending.³¹ Thus, if employment or job creation was factor, non-defense spending would be presumed to be a superior vehicle for achieving that end.

Capital.

Capital is the basic ingredient and medium of exchange and measurement for production. Various enterprises and the government compete for investment funds to fuel production or services and, in the case of enterprises, generate profits commensurate with the risk.

Two observations appear relevant today. First, as noted earlier, venture capital has tended to flow out rather than into defense production. Second, also as noted earlier, there is an increasing concern over government deficit spending and the impact of those deficits on the economy as a whole.³²

Therefore, the opportunity costs of defense spending are particularly apparent in the capital factor of our production equation. A spiral of declining productivity and profitability has reduced the defense production industrial base and reduced the capital and motivation available for increasing productivity. The serious concern about the impact of deficits on the availability of capital for economic growth across the board exacerbates the situation.

Entrepreneurial Skill.

Entrepreneurial skill can make significant differences in the productivity and profitability of industries.³³ In the defense industry, however, there is not a direct link between productivity and profitability.

Defense managers of large prime contractors are motivated more by survival than by maximizing profits. Survival is related more to technical capability and the ability to respond to government requirements than to productivity or cost effectiveness. Dr. Thomas S. Amlie cited the need for large corporations with a commercial mix to segregate the government divisions from those in the competitive market place because of the corrupting effect of government procurement policies and practices.³⁴ I have personally heard a corporate aerospace manufacturing executive declare his firm could not compete in the open market place without an overwhelming technical advantage - they had tried and failed.

I wish to again restate my position that this relative deficiency in cost competitiveness in some wholly defense-oriented firms is not sloth. It is the result of inadequate incentives to be productive and of an environment

that can be hostile toward enhancing productivity. Furthermore, these firms are managed to be responsive to dramatic technical and schedule challenges. The government might be well advised to examine carefully the responsiveness that could be sacrificed in meeting other requirements by a significant, real emphasis on output per manhour gains in productivity. Nonetheless, there appears to be an opportunity for improved productivity through improved entrepreneurial skill in the defense industry.

Commercial industry and business has also been criticized. A short-sighted focus on profits at the expense of quality and a commitment to research are commonly cited.³⁵ Thus, of course, entrepreneurial skill is directly related to technology.

Technology.

The importance of technology to the electronics industry is obvious. The opportunity costs and trade offs may not be so obvious.

The opportunity costs have been bluntly portrayed as a choice. We could compete successfully with the Russians in military electronics or with the Japanese in commercial electronics, but we are lacking the resources to do both.³⁶

These portrayals cite the percentage of electrical engineers and computer scientists absorbed into the defense electronics industries. They also cite the dominance of government research and development funding. It is also sometimes argued that defense contractors bid up the salaries of engineers, eroding the ability of commercial firms to compete. The secrecy, and "need to know" associated with military efforts may also be cited as barriers to learning and technology transfer.

Several observations are appropriate. First, defense used to dominate the high technology electronics market but now commands only a small portion of that market.³⁷ Second, the government funded, defense-oriented research may have provided a foundation for or aided commercial success.³⁸ Third, the trade off of secrecy versus technology growth appears as applicable in many ways to our commercial struggles as to our military ones.³⁹ Let me elaborate briefly.

The commercial market offers millions of potential buyers for standard or tailored versions of standard products such as computers, video games, and the like. The potential in the commercial sector to amortize research and development investments is far greater. The defense market place offers both less demand and more specialized demand. Defense systems designed to operate in hostile physical and electromagnetic environments are not needed or are inappropriately expensive for broad commercial application.

The ideal situation it seems would be for a large corporation to engage in military as well as commercial research and development and then to apply the combined results to both the military and commercial market place. The Westinghouse Electric Corporation is a notable example of a corporation with such a deliberate strategy. They have established "technology insertion" (not merely application) groups to make maximum use of their research products.⁴⁰ Both defense and commercial sectors benefit.

Still others prefer to avoid reliance on Government sponsored research or to maintain an exclusive defense orientation. These strategies reflect both the specific attitudes and characteristics of the markets targeted by the firms.

On balance, however, the search for Government sponsored and funded research and development appears to be the strongest motivator for firms to enter the defense electronics sector in a serious way.

CHAPTER IV
FRAMEWORK FOR INCREASING DEFENSE PRODUCTION BY
REDUCING PERCEIVED OPPORTUNITY COSTS

The frame work consists of four elements designed to counter the barriers to increased defense production.

Stewardship.

The first element of the framework, I suggest, should be stewardship. An improved and publicly recognizable sense of stewardship would address public resistance borne of concern for unneeded requirements and waste. That is we should invite a dual standard of scrutiny for defense and non-defense agencies and use it to our advantage. The vast sums of money that defense spends and the consequences of imprudent spending demand a strong sense of stewardship. A perception of advocating the frivolous and of spending profligately would undermine all other elements of the framework.

To these ends a number of programs have been instituted to attack fraud, waste, and abuse in the Department of Defense. Though apparently not a part of a comprehensive framework designed to secure public support, they are useful and demonstrate awareness of the importance of stewardship to that end.⁴¹

Sensitivity to Opportunity Costs.

In conjunction with a sense of stewardship, a demonstrable sensitivity to opportunity cost is needed. Not only should we assure the validity of our requirements and the integrity of spending to satisfy those requirements, but we should reflect an awareness of the values potentially foregone as the result of defense spending.

This sensitivity would serve the Department of Defense well in two regards. First, it could help counter an image of callousness sometimes attributed to defense spenders. Second, it could help avoid situations where the defense community gets out of touch with changing societal concerns.

The Defense Economic Impact Modeling System (DEIMS) provides the Department of Defense a powerful tool to assess the impact of defense spending. The DOD has so employed the tool, evidence of an existing concern for the opportunity costs of defense spending.

Public Information and Tracking to Longer Range Objectives.

The third element of the framework consists of two parts. The first part is a comprehensive and aggressive public information program. The second part is, in conjunction with that program, to invite a public tracking of progress in achieving longer range objectives. Both must work together.

Once requirements are scrubbed, waste is controlled, and a sensitivity to opportunity costs is achieved; then the public should be made to understand the requirements and the fact that satisfying these requirements fully warrants support - even considering the opportunity costs of the defense expenditures. The public must have true and accurate information that is sincerely and meaningfully conveyed in order to help clear up any misperceptions and to aid the building of an informed consensus.

The results of building an informed consensus may not always be support of defense spending. However, the lack of support should stem from honest differences in values rather than from misunderstanding what was required. The challenge is to convert the complexity of defense spending issues into illustrations that have meaning for the layman. Defense spending requests

should not go unsupported only because they are unexplainable, unless the inability to explain the requests is itself a reflection of an irrational requirement.

Issue by issue consensus building is not enough. The public needs to identify both with where we are going and with our progress in getting there.

A process by which we describe where we are going and how we measure progress to that end is useful for three or perhaps four reasons.

First it helps the defense community clarify its own thinking in that regard. If we can articulate to the public an overall game plan, considering, of course, the need to protect classified information, it will be constructive for us as well. Even more useful would be our tracking progress against the plan. This would force common sense reappraisals of our assumptions. We could be reasonably assured of public reaction if it appeared we were continuing something that no longer made sense. The point is that we would work harder at keeping ourselves honest.

Second, it helps capture public support. The United States public, it seems to me, prefers to or needs to embrace concrete goals and specific accomplishments toward those goals. Perhaps, the Mercury and Apollo programs are good examples. In winning World War II, the North African landings were motivated, in part, it seems by a desire to provide a concrete step for the public to identify with. The same might be said of Doolittle's raid on Tokyo and the initial bombings of Berlin. The American people may not so much lack national resolve as to be unwilling to expend it without being able to visualize the results.⁴²

Third, the example of the defense community may create pressure for similar actions by constituents of the social programs. This would, in my opinion, strengthen these programs and motivate additional cost effectiveness. Thus additional federal resources could be made available, reducing somewhat the perceived opportunity costs of defense spending.

Fourth, it may be useful in our dealings with our allies and our adversaries. It would show resolve and organization. It would also provide greater insight to them that they might be able to use to our detriment. In an open and democratic society such as ours, however, denying information to an adversary may be a less effective strategy than overwhelming an adversary with information.

Clearly, a number of initiatives consistent with this approach are underway. Road shows take unclassified threat briefings to the general public. Brochures describing Soviet Military Power are being circulated by the Defense Department. Even ICAF, following the head of the Army War College, has a program promoting discussions between students and public groups on contemporary issues.

Led by Bath Iron Works, defense contractors are starting to take defense issues to the people. This advocacy advertising appears to be growing.⁴³ Advertisers are unstandably cautious, however, seeking to avoid provoking a public backlash to a perceived propaganda campaign.⁴⁴

Certain longer range goals have been publicized, such as the need for a 600 ship navy. More such goals are needed.

Stability and Dependability.

The last element of the framework addresses one of the major barriers to increasing the productivity in the defense industry. Aggressive efforts are needed to increase the stability and dependability of resource commitments to support defense production.

This is obvious and widely recognized. The Defense Guidance addresses the issue.⁴⁵ The defense spending profile of the current administration appears designed to achieve a stable, dependable growth in defense spending. Initiatives, such as multi-year procurement, directly attack contractor reluctance to invest in production efficiencies because single year production buys provide an insufficient return on those investments.

CHAPTER V

ADDITIONAL SPECIFIC ACTIONS

Consistent with and within the framework proposed, some additional specific actions are suggested.

Stewardship Actions

In a weapons system program office, several specific actions may be useful in developing a greater sense of stewardship of public resources. The key is to "personalize" the responsibility for asset management.

The ideas are simple and straightforward. The budgets are shredded out and individuals and individual organizations are made specifically responsible for their assigned portions. They are to manage those portions as if the money was their own. Furthermore, the items or funds could be depicted in terms the individuals were familiar with. Examples would be multiples of a local church's budget, the hours a local factory worker must work to pay the taxes to fund the item, and so on.⁴⁶ If the program budget could be shredded out in manageably sized portions, and more portions personalized in a graphic way for those responsible, a greater sense of stewardship should result. The danger is that given the demands on program offices, the frustration levels might also increase significantly.

The trick, of course, is to increase the personal specificity of stewardship responsibilities by decreasing the general responsibilities. That is we seek to reduce the financial span of control by making more individuals specifically responsible for the smaller financial spans. And then to try to

depict that financial span in terms that give a personal meaning to the individual responsible. This requires no more people, only more innovation and additional delegations of responsibility and authority to those lower in the program office hierarchy. This would not appear to be more than a logical extension of the way in which many programs are currently run.

Another suggestion is for program offices to employ "viability indicators." The usefulness of a program may be bounded by certain measures reflecting the minimal cost, schedule, technical and, perhaps, political performance necessary to remain viable. Another way of looking at it would be that at some points of performance the funds spent on the program do not justify the opportunity costs.

There are two reasons for advocating such indicators. The first is to make it easier to render prompt euthenasia to suffering programs not warranting additional resource commitments. The second is to provide a vehicle for the program manager to reassess periodically the validity of the basic assumptions inherent in the funding of his programs, to provide a perspective baseline. Let me amplify briefly.

I realize that the DSARC process with its goals, thresholds, and milestones already serves this purpose in a formal sense. I propose no alteration to this system.

What I am suggesting is that the program manager sit down with those above him and agree on an informal list of parameters, which if violated, should cause the very existence of the program to be questioned. The basic assumptions should be understood so that both the program manager and his bosses can recognize when the validity of these assumptions may become questionable.

These parameters, possibly unlike DSARC thresholds, should fully consider the program in the context of other current defense and non-defense efforts. Threat, force mix, tactics, and strategy changes may create conditions where a program no longer makes sense. Of course, cost growth, failure to achieve technical goals, and schedule slips may also mean a program no longer warrants funding and the resources committed to that program should be reallocated.

Recommending program termination has been a program manager responsibility.⁴⁷ So far as I know, however, no program manager has ever recommended his program be terminated. Many programs have been terminated, of course. As I believe that the program manager should have been the first to recognize the need, the program terminations present two problems that might have been intenerated.

First, the delay from time of program manager recognition of a likely termination until an external termination was imposed represents a possible waste of resources.

Second, the externally imposed termination may create confidence and credibility problems that might be avoided if the recommendation for termination flowed from the program manager in a timely manner.

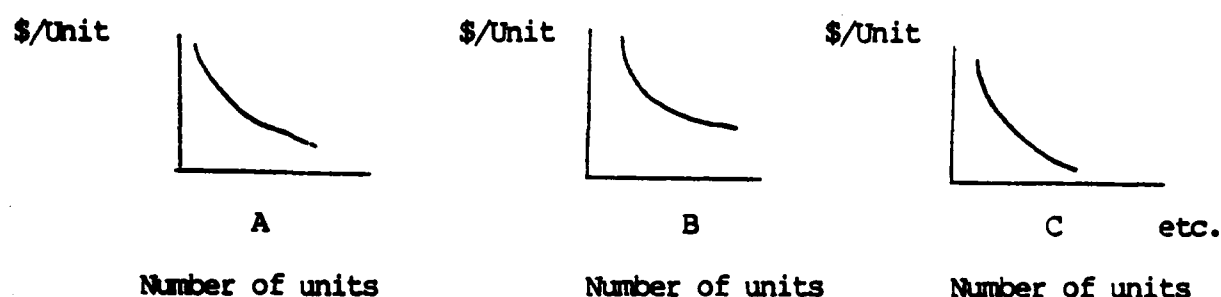
The force of personalities in the weapons system acquisition business is, I submit, a fact of life. The emphasis is to somehow, even against all odds, make something happen. Therefore, unlike a sense of stewardship which should be enhanced by personalization, certain program management decisions should be improved and made more reflective of good stewardship if they could be more impersonal. Prior agreements on "viability indicators" could help in establishing an acceptable, informal, "safe" vehicle for a program manager to alert his boss that the entire program may need to be rethought.

Actions Directly Reflecting Opportunity Costs

There appear to be strategies that could directly consider opportunity costs in the selection of hardware for defense production.

One would be to consider force mixes that take maximum advantages of employing idle capacity. If you can recall the discussion of productive efficiency, we could select hardware mixes and quantities that maximize the production function. This would give us the "most" force out of the existing capabilities. It would directly address the problem of employing idle labor and facilities. Overhead would tend to be minimized. We would be pushing out to and along the current production possibility frontiers.

Another, a variation of the first actually would be to iterate strategy and force mix upon developing an understanding of specific item cost-quantity tradeoffs. That is a defense planner would be presented a series of cost-quantity curves for hardware. For example:



The planner would then estimate the cost of implementing the desired strategy (the number of units of A, B, and C. etc.) to form a baseline. Then by considering different hardware mixes he could see if he might be wiser to

change his strategy to take advantage of being able to get more units more the same dollars using a different force mix.

By using a series of straight lines to approximate the curves, a linear programming approach could be employed. One could try to maximize the number of units produced subject to constraints. The constraints could include total cost and the limitations of time or resources. This would not be unlike the determination of p^* in our discussion of productive efficiency.

Alternatively, one could subdivide the units into categories (strategic, sustainability, tactical, etc.) and specify constraints on the minimum number of units by category. Then, subject to these constraints, we could attempt to minimize the cost.

In reality, there would be yet another dimension to these curves, that of time. The planner would be concerned with unit cost changes as a function of schedule as well. The point remains that optimal production runs in terms of cost, quantity, and schedule balances could be useful in iterating strategies.

Yet another approach would be to consider the "net" cost of production programs to society. This could be done in a variety of ways of differing complexity.

A simple way would be to look at the job creation capability of alternative programs of comparable cost. By picking the program creating the most jobs, the opportunity costs of not being able to fund a jobs program would be minimized.

In the Cobb-Douglas approach program A would have $P_A = AK_A L_A$ and program B would have $P_B = BK_B L_B$. If $P_A = P_B$, then compare L_A and L_B , and pick the program with the largest L.

If a linear programming approach were used, we could compare current production (p) to the maximized production (p^*). Then we would compare the current labor with the labor for maximized production. Everything else being equal we would select the program that increases labor the most.

In input-output approaches we would look for the program with the greatest coefficient of labor, everything else being equal.

The linear programming approaches to maximize production subject to resource constraints or to minimize production cost subject to constraints on the minimum postures to achieve levels of effectiveness could be employed in combination with the net social cost concept. The unit cost curves would be replaced by net (defense plus social) cost curves and techniques employed as before.

First, I realize there are drawbacks and difficulties in using such approaches. On balance, I still consider the approaches worthwhile. Second, in a real sense such approaches have been employed for a long time. I'll discuss the second observation first.

The generic concept being considered is to evaluate defense spending alternatives against criteria that consider the total benefit to society--both in terms of national security and domestic welfare. The long term pattern of major program awards suggests that in some ways that is already being done. Idle plants are filled. The major defense contractors are sustained. General Dynamics won the YF-16 when the work in Air Force Plant 4 had declined. Fairchild Republic built the A-10 in largely idle facilities on Long Island. Work regularly flows in to Air Force Plant 6 for Lockheed-Georgia. And so on.

Let us look at that pattern. Of competing contractors, the one with the greatest idle capacity is also the one most motivated to obtain work. Therefore that contractor is the most likely to bid competitively and is likely to produce the most competitive bid. It may well be that the optimism reflected in the competitive bid of a motivated contractor is a reasonable quantitative measure of social and defense costs of the program. Clearly, redressing regional pockets of high unemployment and preserving the industrial base are laudable goals. The precedence for using defense spending to address such goals was established long ago. Indeed, defense procurement is legislated to such ends. To use a crude analogy, we are no longer discussing whether or not to prostitute defense spending, we are arguing over the price.

To continue, if the high pocket of regional unemployment happens to fall in the district or state of an influential representative or senator, so much the better. That does not per se lessen the value of spending, although it may invite other types of criticism. Even those criticisms may be intenerated by arguments of net social value.

Factors other than job creation can also be considered. In the case of defense electronics research and development and production, one such factor may be the technological impact on our ability to compete with the Japanese.

Another way of looking at the awards would be from a purely political point of view. Though politics is obviously a factor in this nation, true political interference in major procurements appears to be quite rare. There are laws and other directives to that end as well.

Now let me discuss my observation that the gains from such approaches may well offset the drawbacks. First a number of potential drawbacks come to mind.

If awards are based on social or political factors above, then clearly weapon cost, schedule, and performance may be jeopardized. Even just considering social factors could act to discourage productivity investments. A series of awards tied to current capabilities could preserve existing capacity but deny opportunities for innovation, growth, and expansion.

What I am doing, however, is advocating we be, when possible, explicit about the social factors we are considering and that these factors be but one of many considerations. That is close to motherhood and to where we really are now.

There is one big difference. Using the suggested approaches we can better understand the tradeoffs, use these to our advantage, and take credit for them. This could help avert military, contractor, and public frustration, distrust, and misunderstanding.

As for sacrifices in productivity, they could be addressed in two ways. First, the cost savings attributed to efficient production could be applied to or compared with the social contribution of less efficient production. It may be better to make electronic hardware with robots and apply the savings directly to social programs. Second, as I have already shown, there is little real incentive for defense contractors to be truly cost efficient. Therefore, little is lost. Also effective incentives could still be employed and would be reflected in the cost/quantity curves.

Public Information Actions

One suggestion is to publicize the "opportunity benefits" of defense spending. The suggestion is not to advocate defense spending as a vehicle to

address social concerns. The suggestion is to take credit for it when it happens. Service in the Armed Forces has been shown to have a beneficial affect on the earnings patterns of minorities.⁴⁸ Though not directly related to defense production, it could be publicized.

Furthermore the Armed Forces have acted as an employer, trainer, and disciplinarian of last resort. Though this may be changing, we can claim some credit for continuing services in this regard.

The Armed Forces also provides training for some skills--pilots, mechanics, flight controllers, and so on--that benefit commercial industries by reducing the educational and training burden they would have to bear.

Defense spending also provides a spring board for commercial ventures. As noted earlier, defense research and development helped fuel the commercial electronics boom. Submarine reactors provided a prototype for those in nuclear power plants.

Another suggestion is to project the threat carefully and realistically for the public. Alarmist projections and rapidly and inexplicably changing projections should be avoided, if possible, for in the long run they may tend to undermine the confidence of the public.

Though many efforts are underway to project the threat to the public and these efforts may be expanding, there still appears to be significant public uncertainty as to the nature and seriousness of the threat. While much of this uncertainty may always be present, progress appears possible.

Controversies over the nature of the threat, given the nature of our democracy, are likely to be a fact of life. A broad projection of the threat that encompasses or acknowledges differing perspectives may also be helpful.

A public possibly indisposed to defense spending in the first place may consciously or subconsciously look for technical disagreement as an excuse not to support spending perceived as requiring sacrifice.

Also, I suggest that defense contractors and others in or supportive of the defense community should carefully expand issue and image advertising. Traditionally defense marketing and advertising focused on decision makers within the defense community and Congress. While it appears that focus may be starting to change, marketing and advertising remain highly directed and concentrated in defense oriented media. Marketing was oriented to getting a piece of the defense pie and not toward expanding the pie itself. The current administration has demonstrated its intent to expand defense spending based on a serious consideration of the threat. Defense spending increases cannot be sustained without public support. It would appear prudent for the defense community to work to build that support. Care should be exercised to avoid a "backlash."

Stability and Dependability Actions

The suggestion is to use end item demand as an incentive for both productivity and stability. My contention is that end item demand is the only effective incentive to stimulate investments in productivity. Rather than trying to defend that contention, I will try to defend a milder one. End item demand is the most rational incentive to stimulate investments in productivity and is the incentive most consistent with the American perceptions of free enterprise.

Defense contractors appear unlikely to invest in productivity improvements without sufficient demand to amortize that investment. Furthermore, as

previously discussed, the nature of the defense business promotes neither productivity investments nor confidence in sufficiently stable production requirements to amortize the investment.

The effective demand for certain defense products can be increased by pooling the demand for domestic weapons with those for foreign sales. In addition, when commercial products offer promise to effectively satisfy defense requirements, buying the commercial products enables us to benefit from an economy of scale. In certain cases, defense products may well have commercial potential and that may also provide an opportunity to increase effective demand.

I also suggest direct incentives. The government should offer to buy disproportionately larger numbers of items as unit cost decreases. For example, the government would buy 1,000 airplanes at a cost of \$5 million each as opposed to buying only 400 airplanes if the cost were \$10 million each. This incentive could be rolled down to the workers. They would know the harder they worked, the longer the production run, and the greater their job security.

My view is that Americans like to produce. Incentivizing productivity by stimulating demand makes intuitive sense. They can take pride in the output and the value added weapons provide our Armed Forces. Surge planning, while economically sound, may be emotionally unsuited to the United States. Buying fewer end items and spending some of the savings to provide an expansion capability we hope we need never use may reduce the expected costs of production. It may also be difficult to sell to the American people.

CHAPTER VI

CONCLUDING REMARKS

Public support remains key to increasing defense production. The perceived opportunity costs of defense production must be addressed both by clearing up the misperceptions and by internalizing the costs.

The framework suggested for doing that is obvious. Many actions are underway that fall within such a framework. The actions suggested are, for the most part, neither new nor original.

Integrating actions within the suggested framework appears desirable and, perhaps, innovative. Directly considering the net costs of defense programs to society appears to be both original and desirable. Research to expand and evaluate the general approaches suggested appears warranted.

President Eisenhower, in the 1960s dedication of the Academic Building of the Industrial College of the Armed Forces, said:

"Our liberties rest with our people, upon the scope and depth of their understanding of the nation's spiritual, political, military, and economic realities."

To that end, this report is written.

FOOTNOTES

CHAPTERS I-VI (Pages 1-40)

¹See production functions under "econometrics" and other headings in major encyclopedias for simple description of the Cobb-Douglass and other approaches.

²See Jong Keun You, "Capital Utilization, Productivity and Output Gap," The Review of Economics and Statistics, February 1979, p. 91-100; comments by John A. Tatom, "Capital Utilization and Okun's Law," The Review, February 1981, p. 155-158; and You's response, The Review, February 1981, p. 158-160.

³See Edward Mansfield, "Basic Research and Productivity in Manufacturing," The American Economic Review, December 1980, p. 863-873.

⁴David L. Blond, "The Defense Economic Impact Modeling System," Office of the Secretary of Defense, April 1982.

⁵Henry T. Burley, "Productive Efficiency in United States Manufacturing: A Linear Programming Approach," The Review of Economics and Statistics, November 1980, p. 619-622.

⁶The impact of government regulation on productivity, while peripheral to this study, may be significant. See, for example, John S. McClenahan, "How Regulation Shackles Economic Growth," Industry Week, June 1, 1981, p. 64, 66, 68. The Reagan Administration efforts to reduce regulation are discussed in various publications. See, for example, Regulations, January-February 1982, published by the American Enterprise Institute. Also see p. 59 of Jacques Gansler, The Defense Industry, Cambridge: MIT Press, 1982, for potential impact of pollution control requirement on defense industries.

⁷See, for example, International Institute for Strategic Studies, "The Military Balance," Air Force Magazine, December 1982, p. 67-68 and p. 148-151.

⁸Illustrated by the remarks of Walter B. LaBerge, "Defense Acquisition: A Game of Liar's Dice?" Concepts, Winter 1982, p. 58, that the percentage of defense business of total (defense and commercial) business of the top 25 defense contractors has dropped over the last 10 years from about 30% to less than 10%.

⁹Ibid.

¹⁰Gansler, The Defense Industry, Table 9.1, p. 221-222, the root mean sum of \$.55 billion for budget instability and \$1.05 billion for labor instability. For additional comments on instability see also David D. Acker and Harold J. Schutt, "Program Stability: An Essential Element in Improved Acquisition," Concepts, Summer 1982, p. 148-160.

¹¹Bela Gold, Productivity, Technology, and Capital, Lexington, Massachusetts: D.C. Heath and Company, 1979, p. xiii.

¹²See, for example, David Lee Belden, Defense Procurement Outcomes in the Incentive Contract Environment, Technical Report 69-2, Stanford University, 1969; Jean-Piere Ponssard, Military Procurement in France: Regulation and Incentive Contracts, Paris: Centre de Recherche en Gestion, Ecole Polytechnique, January 1980; Harold E. Bertrand, Henry J. Boisseau, Jean C. Lafrance, and Anthony J. Provenzano, Investment Policy for Cost Reduction, LMI Task 76-9 in support of DOD contract number SD-321, Washington: Logistics Management Institute, 30 December 1976; and Gansler, Defense Industry, p. 58-59. There have been continuing efforts and studies toward incentivizing cost reduction and productivity investments in defense industries. The continuation of these efforts and studies, each motivated in turn by the inefficacy of its predecessors provides prime-facie evidence of our ineffectiveness. See also Gold, Productivity.

¹³Gansler, Defense Industry, Table 9.1, p. 221-2, root mean sum of \$1.0 billion for redundant facilities and labor, \$1.5 billion for high overhead, and \$1.35 billion for lack of automation.

¹⁴Don E. Moore, "MIL-STD-1567(USAF): The Billion Dollar Payoff," Proceedings of the 1977 Defense Procurement Research Symposium.

¹⁵Gold, Productivity, p. 148.

¹⁶Gansler, Defense Industry, p. 44-46.

¹⁷Ibid., p. 153-156.

¹⁸The 9 April 1982 draft of a revised Department of Defense Instruction number 5000-2, Major System Acquisition Procedures, lists Socioeconomic Program Implementation as a management consideration.

¹⁹Richard J. Hampton and Richard J. Lorette, "Socio-Economic Objectives - Impact on Civil and Defense Agencies," Defense Systems Management Review, Autumn 1979, p. 78-88; Patrick D. Sullivan, "Socio-Economic Program Impact on Acquisition Management," DSM Review, Autumn 1979, p. 89-98. Table 1, p. 95-98, in the Sullivan Article has a description of the cited programs and others.

²⁰James Fallows, National Defense, New York: Vintage Books, 1982, p. 3 for contemporary reference. Note also President Wilson's Annual Message to Congress, December 1914:

"It is said in some quarters that we are not prepared for war. What is meant by being prepared? Is it meant that we are not ready upon brief notice to put a nation in the field, a nation of men trained to arms? Of course we are not ready to do that; and we shall never be in time of peace so long as we retain our present political principles and institutions....."

²¹Mel Horwitch, Clipped Wings, Cambridge: The MIT Press, 1982, p. 4: ". . . during the 1960s, . . . a new mindset emerged. Gradually disciplines and professions that had . . . been absent from technological decision making enter the . . . debates. . . . Decision making for many large-scale endeavors also became politicized; experts and managers from agencies, research organizations, and corporations gave up more and more decision-making to politicians who operated more or less in public view." The author cites a growth of "technological skepticism" on page 5 and then concludes on pages 5-6, the key historical significance of the defeat of the SST. . . "is the entire evolutionary pattern of the SST conflict - from a limited, conventional matter to a massive societal concern - . . . a pattern of change that has become increasingly common."

²²See, for example, William L. Rivers, "The Press: The Other Government," The Stanford Magazine, Summer 1982, p. 19-25.

²³Interview with a Senate staffer.

²⁴See, for example, John M. Barry, "Debating the Arms Budget In a Slumping Economy," The Washington Post, November 29, 1982, p. A1, A8.

²⁵See, for example, Martin Anderson, "Shake-Out in Detroit: New Technology, New Problems," Technology Review, August/September 1982, p. 56-63, 66-70. The conversion of all North American automobile production assets to have taken place between 1977 and 1984 would have cost \$80 billion.

²⁶Most notably by Rockwell International in trying to build support for the B-1.

²⁷The letter, dated February 1, 1983, was reprinted in Armed Forces Journal International, March 1983, p. 51. Letter included: "Today I am asking. I would invite every Senator to give me a list by March 1, 1983, of any defense-related project in his or her state where a reduction of expenditure could be made because such expenditure is not essential for national defense."

²⁸For an interesting perspective, see Bruce R. Scott, "Can Industry Survive the Welfare State?" Harvard Business Review, September/October 1982, p. 70-84.

²⁹See, for example, Michael B. Packer, "Measuring the Intangible in Productivity," Technology Review, February/March 1983, p. 48-57; and January 1983 issue of Industrial Engineering, devoted to "Productivity Projects in the Service/Support Industries."

³⁰"Washington Perspectives," Military Electronics/Countermeasures, August 1982, p. 4. A differing view was found in Bernie Ward, "Robotics and Reality, Sky, November 1982, p. 23-28.

³¹Robert E. McGarrah, "U.S. Strategies for Industrial Growth and Western Security," Parameters, December 1982, p. 62-70; Alan F. King, "Business Deals with the Soviets," incorporated into "The Nuclear Arms Race: Views from Three Professions," Technology Review, February/March 1983, p. 21-23. McGarrah cites statistics from the U.S. Department of Labor, 1975. King cites estimates by the Council on Economic Priorities. DEIMS and other U.S. input-output models reveal this as well.

³²Michael Blumenthal, John B. Connally, C. Douglas Dillon, Henry H. Fowler, Peter G. Peterson, William E. Simon fonders, "A Bipartisan Appeal to Resolve the Budget Crisis," slides from 19 January 1983 news conference.

33See, for example, Arnold S. Judson, "The Awkward Truth About Productivity," Harvard Business Review, September/October 1982, p. 93-97.

34T. S. Amelie, "Defense Acquisition - Some Observations and Suggestions," unpublished paper, quoted in Fallows, National Defense, p. 64.

35See most especially, William J. Abernathy and Robert H. Hayes, "Managing Our Way To Economic Decline," Harvard Business Review, July/August 1980, p. 67-77; and David A. Garvin and Robert H. Hayes, "Managing As If Tomorrow Mattered," Harvard Business Review, May/June 1982, p. 70-79.

36This was the subject of the Jessica Savitch Frontline television program, "Pentagon, Inc." shown in the Washington area on the PBS station WETA, Channel 26, 21 February 1983, 2000-2100 hours, and of an article by John Tirman, "The Militarization of Route 128," The Boston Globe Magazine, August 15, 1982, p. 14+.

37The defense share of factory electronics sales was reported by one industry executive to have declined from about 60% to about 9%. Total electronic factory sales, according to the Electronic Industries Association 1982 Electronic Market Data Book, p. 4-5, to have grown from \$3.663 billion in 1950 to an estimated \$113.774 billion in 1981.

38See, for example, David L. Blond, "The Myth of the Vanishing Defense Resource The Impact of Defense Spending on the American Economy," unpublished paper, c. 1982. Allan S. Milward, War, Economy and Society 1939-1945, Berkeley: University of California Press, 1979 noted (p. 169-170) that war promoted technology and scientific innovation which led in turn to economic growth.

39The Soviet threat has been documented in an unclassified report, "Soviet Acquisition of Western Technology," April 1982, distributed by the CIA. The "International Intelligence" column (p. 15-16) of the August 1982 Military Electronics/Countermeasures refers to "The Japanese high-tech ripoff" and also notes "The Justice Ministry in Japan has indicated it will not extradite Hitachi, Ltd. employees involved in the IBM espionage case. . . ." For a reasoned, and not altogether hostile perspective, see Paul E. Gray, "The University Case Against Secrecy," Technology Review, July 1982, p. 10-12.

40Interviews with Messrs Don Betts and Zane Collins, Westinghouse Electric Corporation, Defense and Electronic Systems Center, Command and Control Division, principally on 27 October 1982.

41There is a danger, however, that the public might perceive the existence of such progress as confirmation rather than control of fraud, waste, and abuse. For a differing perspective see Edward N. Luttwak, "Why We Need More Waste, Fraud, and Mismanagement In The Pentagon," Commentary, February 1982, p. 17-30.

42See, for example, Herbert London, "The American Character and Military Policy," Defense Science 2000+, May/June 1982, p. 60-62.

43See Frank Greve, "Defense Firms Go On The Offensive With Full Page Newspaper Ads," Charlotte Observer, December 26, 1982, p. 25A; Advertising Age Magazine, p. M1-M48, Advertising Age, January 24, 1983 feature on corporate image advertising. My opinion was also reinforced by that of a representative of the Technical Marketing Society of America. Even Smith Kline Corporation took out a three page ads in the March 2, 1981 issue of Newsweek to highlight the Soviet threat.

44For a discussion of some of the pitfalls of such advertising see, David Kelley, "Critical Issues For Issue Ads," Harvard Business Review, July/August 1982, p. 80-87. See also the Advertizing Age issue referenced in note 43 above.

45Unclassified extracts of the Secret Defense Guidance FY1984-1988, 22 March 1982: "(U) Cross - Service capabilities will be assessed against the following criteria:

--(U) The stability and responsiveness of acquisition programs."
"--(U) . . . program stability should have the highest management emphasis in making the most efficient use of available resources." "--(U) The USDRE will maintain a Stable Program List for the Defense Resources Board to reflect a collective top management commitment to stability in selected high priority major acquisition programs."

46For an interesting perspective see, John Carley, "Kill the B.S., Tell Us About the Military," Armed Forces Journal International, February 1983, p. 73-80.

⁴⁸Dudley L. Poston, "The Influence of Military Service on the Civilian Earning Patterns of Blacks, Mexican Americans and Anglos," Journal of Political and Military Sociology, Spring 1979, p. 71-88.

END

FILMED

3-84

DTIC